

Reprinted from THE GARDENERS' CHRONICLE, August 17th, 1929.

EXPERIMENTS ON THE CAUSE OF "POTATO SICKNESS."

FIELD observations carried out in south Lincolnshire since 1925 have shown that the two organisms *Corticium* (*Rhizoctonia*) *Solani*—a fungus, and the eelworm, *Heterodera* *Schachtii*, are invariably present on Potato plants exhibiting symptoms of the disease known to growers as "Potato Sickness."

It may be of interest to record here that although the disease is usually associated with fields which have been frequently cropped with Potatoes—hence the name "Potato Sickness"—a bad case of similar crop failure came under observation in 1926, when a field of "old" pasture was freshly ploughed up (Fig. 66).*

In general, the whole of these field observations have indicated that Potato Sickness is a similar phenomenon to those of Clover Sickness and Greenhouse Soil Sickness, and is caused by plant parasites rather than starvation, or any accumulation of toxins in the soil.

In 1928, working in conjunction with Mr. E. Edwards—then Entomologist at Kirton Agricultural Institute—a series of pot experiments were set up in order to obtain some definite evidence as to the parts played by the fungus and the eelworm in causing this disease.

Soil was obtained from a Potato field of very bad record for "sickness" in the Boston area—a field where Potatoes had been grown year after year for the past eighteen years, and the following series of pots were made up; five ten-inch flower pots being finally used in each series.

Series.	Inoculations.†
1. Soil Sterilised‡	Nil.
2. " "	Inoculated with the fungus, <i>Corticium Solani</i> .
3. " "	Inoculated with about 2,500 cysts of the eelworm, <i>Heterodera Schachtii</i> .
4. " "	Inoculated with the fungus and the eelworm (about 2,500 cysts).
5. Unsterilised soil	Nil.

A small quantity of a mixture of inorganic artificial manure composed of three-parts sulphate of ammonia, four parts of superphosphate, and two parts of sulphate of potash, was applied in equal amount to each of the pots, and they were planted with a very susceptible variety of Potato—Eclipse, the "seed" being previously immersed in an 0.1 per cent. mercuric chloride solution for one-and-a-half hour to ensure the exclusion of *Corticium Solani*.

The pots were plunged in the soil of an isolated garden, and apart from occasional waterings were kept under field conditions.

The outcome of the experiments in 1928 was not altogether satisfactory; the reduction in

growth of the plants receiving double inoculation (Series 4) being less than that of those grown in the untreated soil (Series 5), and there was little difference between the sterilised (Series 1)

the soil of Series 2 and 4, while further inoculations of approximately equal numbers of eelworm cysts were given to Series 3 and 4.

The pots were again planted with "steeped



FIG. 66.—POTATO SICKNESS: EDGE OF A BAD PATCH IN FOREGROUND.

and those inoculated with *Corticium Solani* (Series 2).

These results, together with a detailed account of the symptoms of the disease were published by Mr. E. Edwards, since leaving Kirton, in the *Journal of the Ministry of Agriculture*, June, 1929 (q.v.). Following the experience of 1928, the plants were taken out of the pots and the

seed" of Eclipse Potatoes on April 15. No manure was applied to the soil.

The season was marked by its low temperature and lack of growing weather; conditions which field observations have shown to favour Potato Sickness.

The effect of the inoculations showed up well (Fig. 67), and throughout the growing

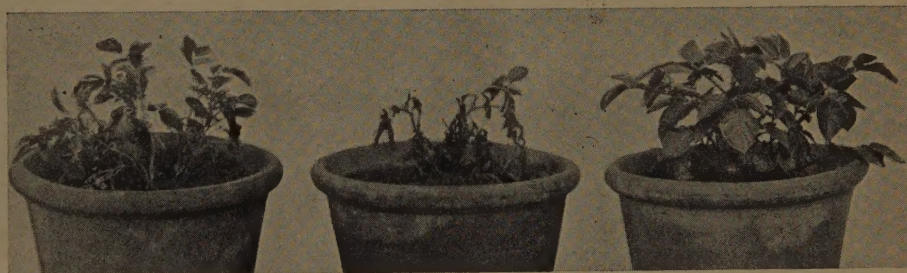


FIG. 69.—POTATO SICKNESS.

Left, "Unsterilised" Series 5; Centre, "Eelworm" Series 3; Right, "Fungus" Series 2.

soil replaced back in each pot. Very great care was taken to avoid any contamination of the soil of one series by that of another.

The pots were kept plunged in the same site outdoors during the following winter, 1928-29, and in the middle of March, 1929, additional inoculations of *Corticium Solani* were given to

period Series 1 showed a great increase in growth over all the others.

The "eelworm" Series 3, was better than Series 2, 4 and 5, at the commencement, but its growth gradually fell back until there was little difference between these Series at the end of May. The third week in June, the rate of growth

* Only the fungus was observed in this case—not the eelworm. Similar crop failure occurred on control plots in bad areas of this field the following year.

† All the inoculations were carried out at the time of planting the tubers. The fungus was obtained the previous year from a diseased Potato stem, and had since been grown on Potato-mush agar. The inoculation was made by cutting out "squares" of fungus and agar, and placing them in the soil.

‡ Sterilised in an autoclave.



FIG. 67.—POTATO SICKNESS: RESULT OF INOCULATIONS IN 1929.

A. "Sterilised" Series 1; B. "Double Inoculation" Series 4; C. "Fungus" Series 2; D. "Unsterilised" Series 5; E. "Eelworm" Series 3.



FIG. 68.—POTATO SICKNESS: RESULT OF INOCULATIONS IN 1929.

A. "Sterilised" Series 1; B. "Double Inoculation" Series 4.

of Series 3 was negligible, and finally, with one exception, the foliage turned completely yellow by the end of the first week in July, and within a few more days was dead.

The "fungus" Series 2, was at first much retarded, but tended to pick up towards the end of June, and then in great contrast to the "eelworm" Series 3, continued to grow and retain a perfectly healthy colour in the second week of July, despite the fact that the Corticium stage of the fungus was abundant at the base of the stems. (Fig. 70).

The "double inoculation" Series 4 was outstanding. It entirely failed to grow away and the little growth which was made turned yellow, wilted, and died towards the end of June. The mycelium of *Rhizoctonia* was much in evidence on the soil around the stems.

The "unsterilised" Series 5 showed a check in the very early stages—similar to that of the "fungus" Series 2, but it did not turn yellow and die away so early as the "eelworm" Series 3. The yellow coloration and death was quite eight or nine days later—the Corticium stage of the fungus being plentiful at the foot of the stems.

On the whole, its growth appeared to be slightly better than the "eelworm" Series 3, but markedly inferior to the "fungus" Series 2.

With such a small quantity of material available it was not possible to obtain any precise data to show the relative effects of the different inoculations on the growth rates.

In July the tops were cut off at ground level and the dry weights determined—by that time the "sterilised" Series 1 was becoming pot-bound. Nevertheless, the dry weights are interesting.

	Mean dry weight of four plants (growth above ground.)
"Sterilised" Series 1 ...	12.46 gms. \pm 0.51
"Fungus" Series 2 ...	4.6 gms. \pm 0.55
"Eelworm" Series 3 ...	4.45 gms. \pm 0.92
"Double Inoculation" Series 4 ...	1.58 gms. \pm 0.16
"Unsterilised" Series 5 ...	3.58 gms. \pm 0.54

An estimation of the leaf area of an average plant from each series was made (using the "squared paper—proportional weight" method).

	Leaf Area.
"Sterilised" Series 1 ...	1846
"Fungus" Series 2 ...	646
"Eelworm" Series 3 ...	450
"Double Inoculation" Series 4 ...	121
"Unsterilised" Series 5 ...	327

SUMMARY.

Pots of soil obtained from Potato Sick land, and sterilised, were heavily inoculated in 1928 and 1929 with *Corticium Solani* and *Heterodera Schachtii*. They were planted each year with "steeped seed" of Eclipse Potatoes and kept outdoors.

The Potato plants in 1929 failed to make much growth and died at the end of June showing identical symptoms to those of extreme cases of "Potato Sickness Disease," whereas a series of uninoculated controls (same soil) growing side by side made good growth and were quite normal.

Similarly two series, one inoculated with the eelworm only, and another solely with the fungus, failed to make as good growth as that of the control. In the case of the "eelworm" series the haulm turned yellow and died at the end of the first fortnight in July. The "fungus" series was a natural colour at that time. *W. F. Cheal, D.I.C., Kirton Agricultural Institute.*



FIG. 70.—POTATO SICKNESS.

"Unsterilised" Series 5 (from Fig. 69), showing Corticium at base of stems; July, 1929.



FIG. 71.—POTATO SICKNESS.

"Fungus" Series 2 (from Fig. 69) showing Corticium at the base of the stems.

